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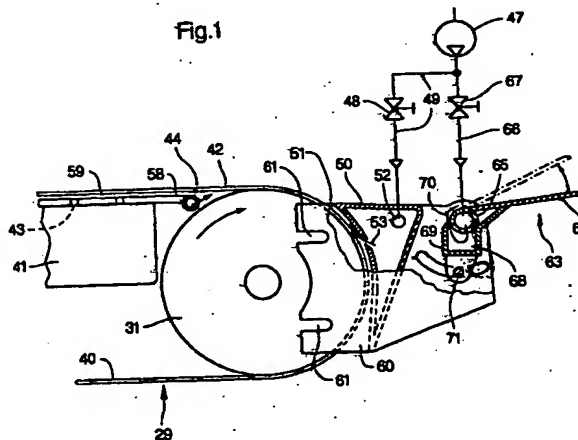
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### (54) Apparatus for transporting a web

(57) An apparatus and process for transporting at least a portion of a web of flexible material between first and second structures spaced from each other. The apparatus includes an elongated frame, at least two pulleys located at each end of the frame, and an air-pervious endless belt movably mounted on the first and second pulleys. The belt has a run traveling from the first pulley, adjacent the first structure, to the second pulley, adjacent the second structure, and the belt is adapted and arranged to receive the at least a portion of the web from the first structure. A vacuum chest having a perforated wall is positioned adjacent to the run of the endless belt, and a vacuum supply device is adapted for evacuating air from the chest, so that a vacuum is applied to suction the at least a portion of the web onto the endless belt. A nose shoe is disposed beyond the second pulley and spaced from the second pulley, so as to define an opening between the nose shoe and the second pulley at a position where the at least a portion of the web leaves the endless belt. The nose shoe includes an inlet adapted to receive a supply of air, and an air jet outlet positioned adjacent the second pulley, and the air jet outlet is adapted to direct at least one air jet into the opening in a direction contrary to a rotation of the second pulley, such that the at least one air jet is sufficient to lift the at least a portion of the web from the endless belt. A guiding tray is arranged beyond the nose shoe having an upstream section positioned adjacent the nose shoe, and the upstream section includes an air slot, which extends cross-wise to a web travel direction, adapted for emitting an air curtain that flows along the surface of the guiding tray. The process includes The process includes transferring the at least a portion of

the web from the first structure onto the endless belt, holding the at least a portion of the web onto the endless belt through suction applied by the suction box, directing air from the air jet outlet through the opening in a direction against a rotational direction of the second pulley, transferring the at least a portion of the web from the endless belt to the nose shoe, and directing an air curtain from the upstream section of guiding tray along a surface of the guiding tray, such that the at least a portion of the web is guided over the guiding tray.

Fig.1



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## Description

## FIELD OF INVENTION

[0001] This invention relates to an apparatus for transporting a web of a flexible material between a first and a second position. In particular, and in a preferred embodiment, the invention provides an apparatus, known as a "vacuum conveyor", for transporting a web, preferably a lead strip of a paper web from the dryer of a paper-making machine to the first nip of a calender of the machine or to a winding machine or between any other sections of a paper-making or paper-finishing (e.g. coating) machine.

[0002] The present invention is intended to improve the apparatuses described in U.S. Patents Nos. 3,355,349 and 4,022,366. All features disclosed in these patents are incorporated into the present patent application by reference.

## DESCRIPTION OF PRIOR ART

[0003] U.S. Pat. No. 3,355,349 issued on Nov. 28, 1967 describes an apparatus for transporting a lead strip of paper web from the dryer of a paper-making machine and feeding into the first roll nip of the calender of said machine. The apparatus comprises an elongated body, an air-pervious endless belt movably mounted on the frame and having a conveying run, e.g. its upper run travelling from the dryer to the first roll nip of the calender. The belt is arranged to receive the lead strip from the dryer. A vacuum chest having a perforated top extends longitudinally of and below the upper run of the belt. There are means for evacuating air from the chest so as to apply the lead strip to cling to the belt. Air blast means beneath, and extending transversely of, the upper run of the belt are positioned at the discharge end. These air blast means direct a blast of air upwardly through the belt to lift the lead strip from the belt and extend the lead strip towards the first roll nip of the calender. Thus, the apparatus described in the above United States Patent is provided with means for ensuring that the lead strip is temporarily attached to the conveying run of the belt and with means to ensure that the lead strip can leave the belt at the appropriate time.

[0004] U.S. Patent 4,022,366 issued on May 10, 1977 provides an improvement to the apparatus of the above U.S. Pat. No. 3,355,349. Said improvement comprises means defining an opening where the web or lead strip leaves the belt and an air jet means able to direct air through the opening in a direction contrary to the direction of movement of the belt and with a strength sufficient both to overcome any gripping effect of air entrained within the air-pervious belt and to lift the web of flexible material.

[0005] In a preferred embodiment, the above apparatus has a discharge shoe or "nose shoe" disposed beyond the second pulley and spaced slightly from the

second pulley to define an opening between the shoe and the second pulley. Provided is an inlet into the shoe to receive a supply of air, a plurality of outlets disposed in the nose shoe adjacent the second pulley whereby an air jet may be directed through the opening and against the web in a direction contrary to the rotation of the second pulley.

[0006] The above apparatus has been found to be effective with paper of the heavier basis weights. The system is able to project such paper forward and, by varying the air flow, may control the angle of trajectory in relation to the belt face. However, lightweight tissues still give problems. Lightweight tissue has been found to fall over the end of the shoe out of control. Accordingly, in a further improvement the apparatus of U.S. 4,022,366 includes a second air jet means, downstream from the first air jet (that is the means able to direct air through the opening); the second air jet means being able to direct air downstream to act as a platform for the web. The second air jet means is preferably provided with holes that are small in diameter to give a velocity flow with minimum air volume. The tissue web will not fall through this air stream until the stream is too weak to provide support.

[0007] The improved apparatus works well in most circumstances but it has been found that as the velocity of the paper-making or paper-finishing machines is increased up to more than 2000 meters per minute, it becomes more and more difficult to properly project the web or lead strip from the downstream end of the apparatus to the following structure or to the following section of the machine. The reason for that problem is that the web or lead strip tends to twist so that it cannot enter in a straight line into the following structure or section, e.g. into the first nip of a calender. The present invention seeks to avoid this disadvantage and to provide a further improvement to the apparatus described above.

## SUMMARY OF THE INVENTION

[0008] According to the present invention the apparatus has again a discharge shoe or a "nose shoe" beyond the second pulley wherein a plurality of outlets are disposed adjacent the second pulley. Air jets may be directed through the outlets against the web or lead strip in a direction contrary to the travelling belt. In addition to that nose shoe, the following device is arranged immediately beyond the nose shoe: A (so-called) guiding tray, e.g. in form of a metal plate, extends along the web path. In the upstream section of the guiding tray, an air slot is provided which extends across the web path. This air slot is adapted to emit an air jet or air curtain, first approximately perpendicular to the guiding tray. However, this air jet is immediately turned - by means of the known Coanda effect - into a direction approximately parallel to the guiding tray. For this purpose, the air slot is connected to the guiding tray by means of a rounded edge. Said Coanda effect is also used to entrain the tail

of the paper web or lead strip in a very controlled manner in the direction of the-guiding tray as the tail leaves the nose shoe.

[0009] Preferably, said guiding tray may be pivoted around an axis which is arranged across the web travel direction. This axis may be close to said rounded edge. Thereby, the guiding tray may be angularly adjusted for targetting of the entrained tail at multiple selectable discharge angles. In summary, the invention provides a new design which is effective at all transfer speeds. But it provides a significant improvement over the prior art, particularly at extremely high paper transfer speeds, e.g. between 2000 and 3000 meters per minute.

[0010] A further improvement may be achieved by a second air slot arranged at the downstream end of the guiding tray, e.g. between said metal plate and an auxiliary plate arranged parallel to the metal plate, similar to German Utility Model G 91 09 313.9. Said auxiliary plate may extend beyond the downstream end of the guiding tray being effective as a prolongation of the guiding tray.

#### BRIEF DESCRIPTION OF THE DRAWING

[0011] The attached drawing illustrates the invention, by way of example:

Fig. 1 shows the downstream section of a vacuum conveyor, partly in a side view, partly in a longitudinal section.

Fig. 2 shows a modification of the conveyor or shown in Fig. 1.

#### DESCRIPTION OF PREFERRED EMBODIMENT

[0012] The conveyor designed according to the present invention comprises an endless belt 29 that extends between a pair of belt pulleys, namely a first (upstream) pulley, not shown and a second (downstream) pulley 31. Belt tensioners are provided which are of known construction and are not therefor described here. Side frames may be connected to the vertical sides of an elongated chest 41. Chest 41 is located between the lower run 40 of the belt 29 and its upper run 42. Chest 41 extends longitudinally of the conveyor belt 29 between said pulleys. The chest has a perforated wall located adjacent to and parallel to one of said belt runs, whis is the conveying run. With the illustrated design, the perforated wall is adjacent to the upper run 42 of the belt. An opposite design may also be provided. The perforations may take any desired form, for example, holes 43. The chest 41 is also provided with a conduit which is connected by suitable air line to a vacuum pump (not shown). Different from Fig. 1, other means to create vacuum or negative pressure at the conveying belt run my also be utilized.

[0013] Beyond the second pulley 31, a "nose shoe" or discharge shoe 50 is positioned. This shoe 50 is

spaced from the pulley 31 to define an opening 51. This shoe functions as a shaped air receiver to give maximum effect to air flow through jets 53 which make up a first air jet means. The shoe 50 is provided with an inlet 52 that is connected via line 49 and control valve 48 to a source 47 of compressed air. The shoe is provided with angled outlets 53 able to direct air through the opening 51 between the second pulley 31 and the shoe 50. The air is specifically directed in a direction contrary to the direction of movement of the belt 29, that is contrary to the direction of rotation of the pulley 31.

[0014] The shoe 50 is provided with two brackets 60 formed with openings 61 so that it may be mounted on the apparatus. Downstream of shoe 50, the brackets 60 support a guiding tray 63 which comprises a metal plate 64 and a pipe 65 connected to plate 64 at its upstream end. Pipe 65 is pivotally supported in bearings (not shown) connected to brackets 60. The interior of pipe 65 is connected via line 66 and control valve 67 to said source 47 of compressed air. An air flow is induced from pipe 65 through openings into a chamber 68. A wall 69 of this chamber 68 forms together with pipe 65 an air slot which extends across the web path. An air jet 70 is emitted by said air slot and is turned by means of the rounded external surface of said pipe 65 - due to the Coada effect - into a direction parallel to plate 64. The guiding tray 63 may be fixed, in a selectable angular position, to the brackets 60, e.g. by means of a bolt 71. Extending transversely across the conveyor and located beneath the belt 29 and between the chest 41 and the pulley 31, there may be arranged a perforated pipe 44 which is connected by suitable conduits (not shown) to said air source 47. The perforations in the pipe are arranged so that when air pressure is applied to the pipe the air blast issuing from the perforation will be directed in a direction upwardly against the underside of the belt 29 and forwardly through the same. This may, in some cases (dependent from the paper grade or transfer speed) help to lift the tail of the web or lead strip from the belt 29. However, it is expected that in many cases, pipe 44 may be dispensed with, so that air streams 53 are the sole means to lift the tail from belt 29. In other cases, where pipe 44 is present, it may be possible that air streams 53 are dispensed with.

[0015] The modified apparatus shown in Fig. 2 comprises a guiding tray 63A which has - in addition to plate 64 - an auxiliary plate 72 connected to the walls of chamber 68 and extending preferably beyond the downstream end of plate 64. Both plates 64 and 72 form a second air slot 73.

[0016] A feature of the invention that can be particularly useful if there is a possibility of static electricity causing the paper to tend to cling to the shoe 50 is the provision of small outlets 62 in the upper surface of the shoe 50. The holes 62 may direct air at an angle to the surface or normal to the surface to overcome any tendency of certain types of paper being attracted to the surface by electrostatic charge.

[0017] The device of the present invention can be used wherever it is desired to move a web of flexible material, particularly paper, across a gap. The invention is of particular importance where it is required to project a paper tail across an open space and send it to a position where the tail can be picked up and fed to the following machine section, e.g. a reel.

#### Claims

1. In an apparatus for transporting a web of a flexible material or a lead strip of said web between two structures spaced from each other, the apparatus including an elongated body, an air-pervious endless belt movably mounted on first and second pulleys positioned at each end of the body, the belt having a conveying run travelling from the first pulley, adjacent the one structure, to the second pulley, adjacent the other structure, and arranged to receive the web or a lead strip of the web from the one structure, means to create a negative pressure at the inside of the conveying run of the belt, in order to cause the web or the lead strip to cling to the belt,
  - a nose shoe disposed beyond the second pulley and spaced slightly from the second pulley to define an opening between the shoe and the second pulley where the sheet leaves the belt, an inlet into the shoe to receive a supply of air, air jet means disposed in the nose shoe adjacent the second pulley whereby an air jet may be directed into the opening in a direction contrary to the rotation of the second pulley sufficient to lift the web of flexible material from the belt,
  - a guiding tray arranged beyond the nose shoe having an upstream section disposed adjacent to the nose shoe; in the upstream section an air slot being provided across the web travelling direction for emitting an air curtain flowing along the surface of the guiding tray.
2. An apparatus according to claim 1, wherein the direction of air flow through said air slot is approximately perpendicular to the guiding tray.
3. An apparatus according to claim 2, wherein the upstream section of the guiding tray has a rounded edge for turning the air flow emitted from said air slot into a direction approximately parallel to the guiding tray.
4. An apparatus according to claim 3, wherein the upstream section of the guiding tray comprises a pipe which forms said rounded edge and which forms an air feeding conduct to said air slot.

5. An apparatus according to one of the preceding claims, wherein the guiding tray is pivoted around an axis extending across the web travel direction in the area of said upstream section.
6. An apparatus according to claim 5, wherein said axis is the axis of said pipe.
7. An apparatus according to claim 1, wherein a second air slot is arranged at the downstream end of the guiding tray.

Fig.1

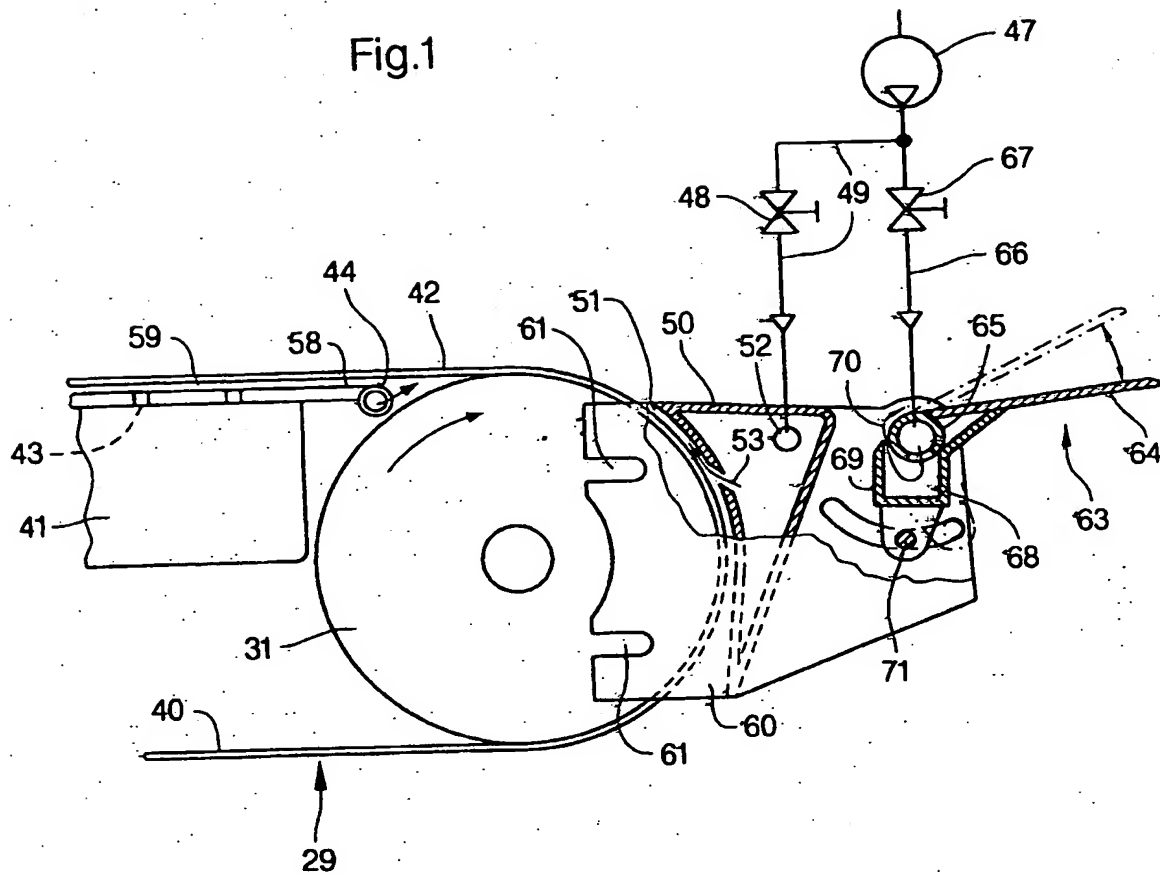
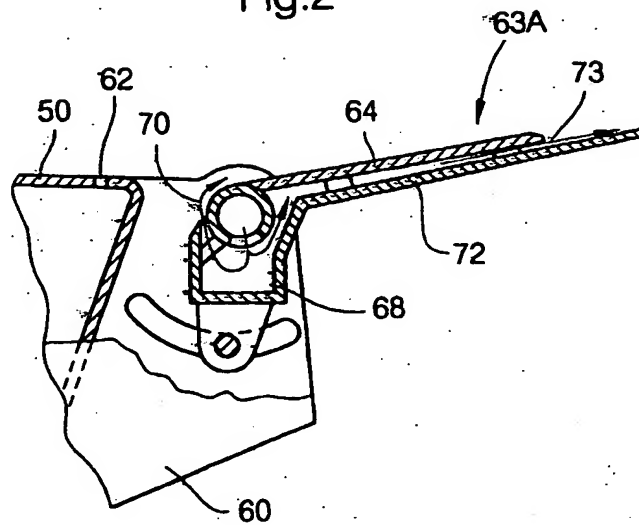


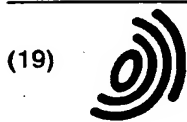
Fig.2



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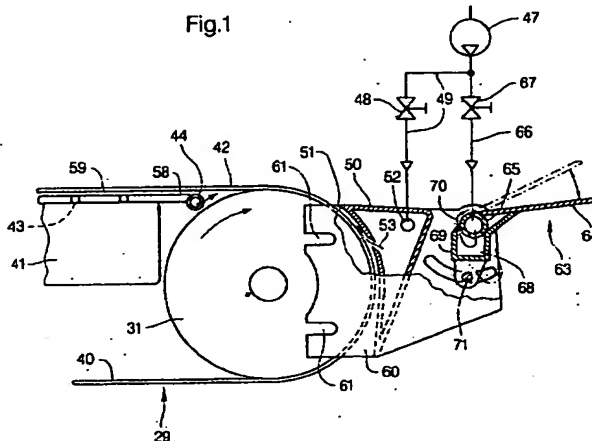
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### (54) Apparatus for transporting a web

(57) In an apparatus for transporting a web of a flexible material or a lead strip of said web between two structures spaced from each other, the apparatus including an elongated body, an air-pervious endless belt (29) movably mounted on first and second (31) pulleys positioned at each end of the body, the belt having a conveying run travelling from the first pulley, adjacent the one structure, to the second pulley, adjacent the other structure, and arranged to receive the web or a lead strip of the web from the one structure, means to create a negative pressure (41) at the inside of the conveying run of the belt, in order to cause the web or the lead strip to cling to the belt,

a nose shoe (50) disposed beyond the second pulley and spaced slightly from the second pulley to define an opening (51) between the shoe and the second pulley where the sheet leaves the belt, an inlet (52) into the shoe to receive a supply of air, air jet means (53) disposed in the nose shoe adjacent the second pulley whereby an air jet may be directed into the opening in a direction contrary to the rotation of the second pulley sufficient to lift the web of flexible material from the belt, a guiding tray (63) arranged beyond the nose shoe having an upstream section disposed adjacent to the nose shoe; in the upstream section an air slot being provided across the web travelling direction for emitting an air-curtain (70) flowing along the surface of the guiding tray.

Fig.1





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## EUROPEAN SEARCH REPORT

Application Number  
EP 00 11 5156

| DOCUMENTS CONSIDERED TO BE RELEVANT  |  |  |  |
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| Category   | Citation of document with indication, where appropriate, of relevant passages  | Relevant to claim                                      | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
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|  |  |  | TECHNICAL FIELDS SEARCHED (Int.Cl.7)         |
|  |  |  | D21G<br>B65H<br>D21F                         |
| The present search report has been drawn up for all claims   |  |  |  |
| Place of search<br><b>THE HAGUE</b>  |  | Date of completion of the search<br><b>17 May 2001</b> | Examiner<br><b>Help16, T.</b>                |
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

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